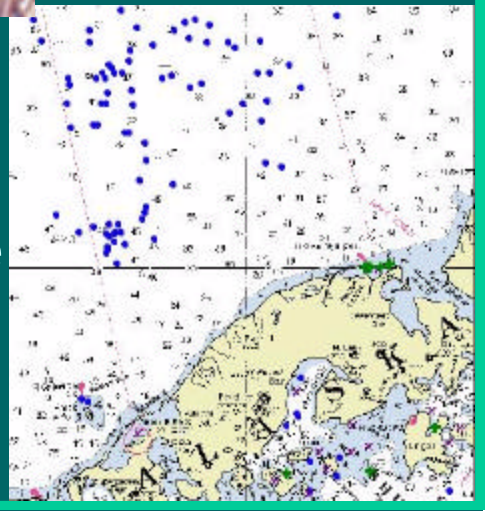
SAR Applications to Alaska Fisheries

Fritz Funk

Alaska Department of Fish and Game



Distribution of Fishing Fleets

- Individual vessels not identifiable
- Fleet is entity of interest
- Pulses of Fishing Effort: Identifiable Fleet
- Want: Numbers of Vessels, Distribution

Fishery Applications

- Red King Crab: (observer hypothesis)
- Opilio Crab: (inseason effort distribution)
- Herring: (decision support system)

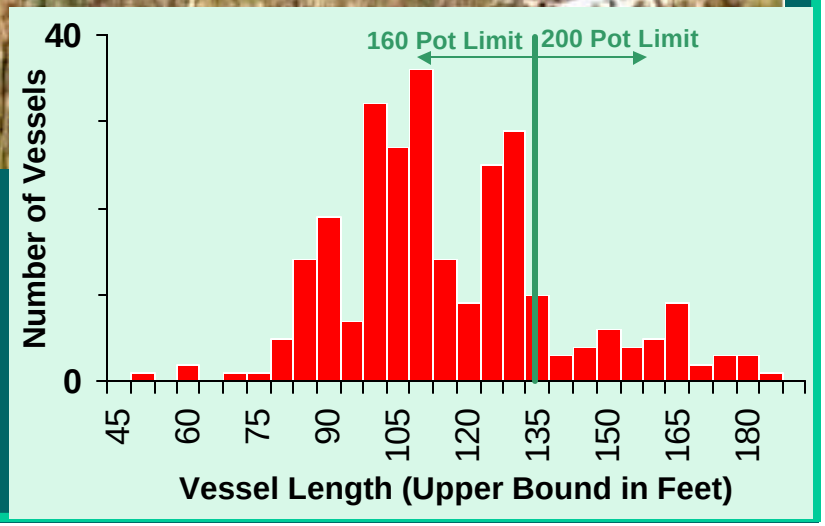
1999 Bristol Bay Red King Crab Fishery

- Large High Valued ($16 per lb!)
- 1999 Fishery:
  - $70,000,000
  - 5 days
  - 271 vessels

Jeff Fortune shows off a king crab recently caught in Lynn Canal, SE AK.

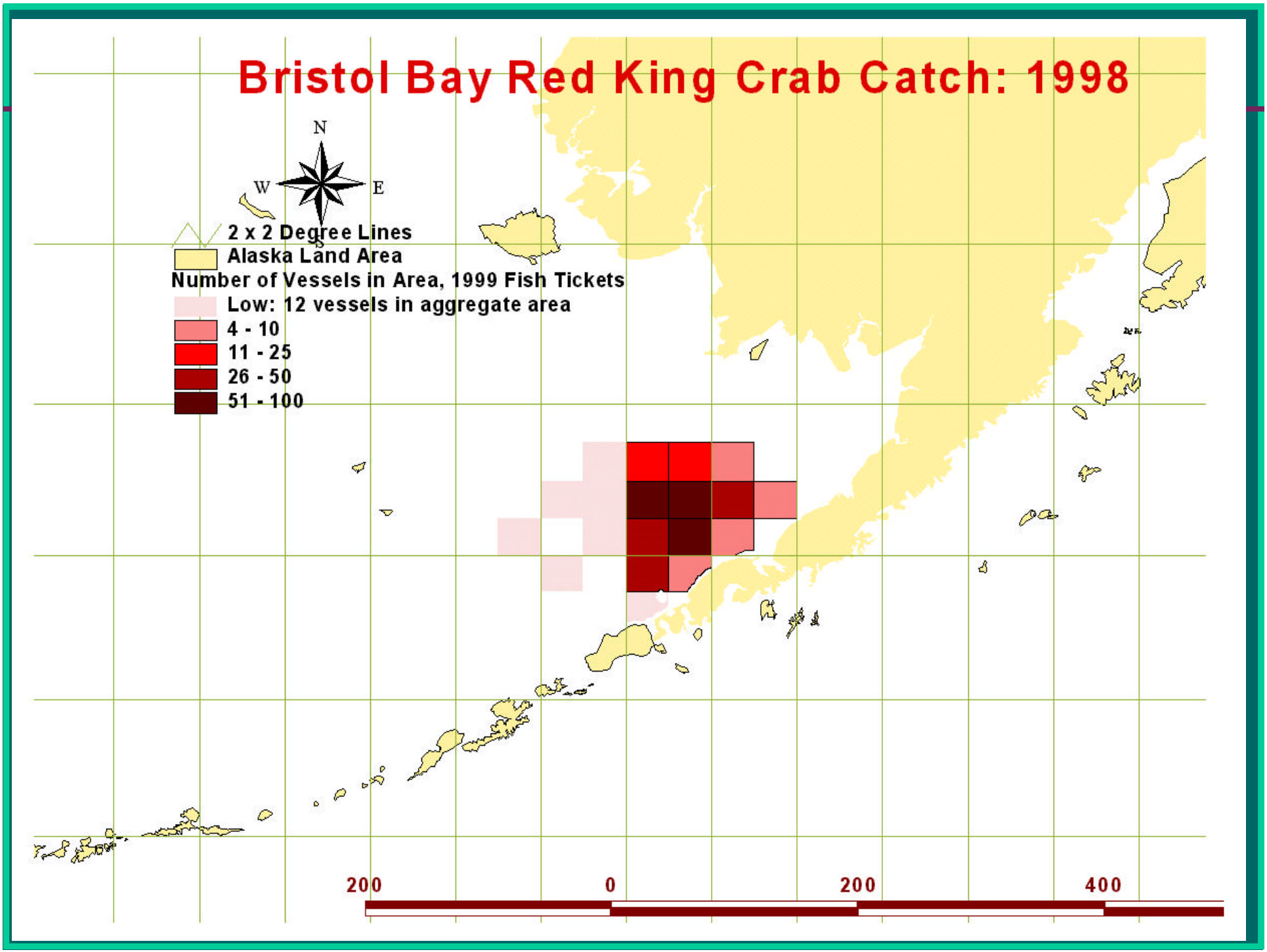
– ©1997 K. Savikko –

Large Steel Vessels

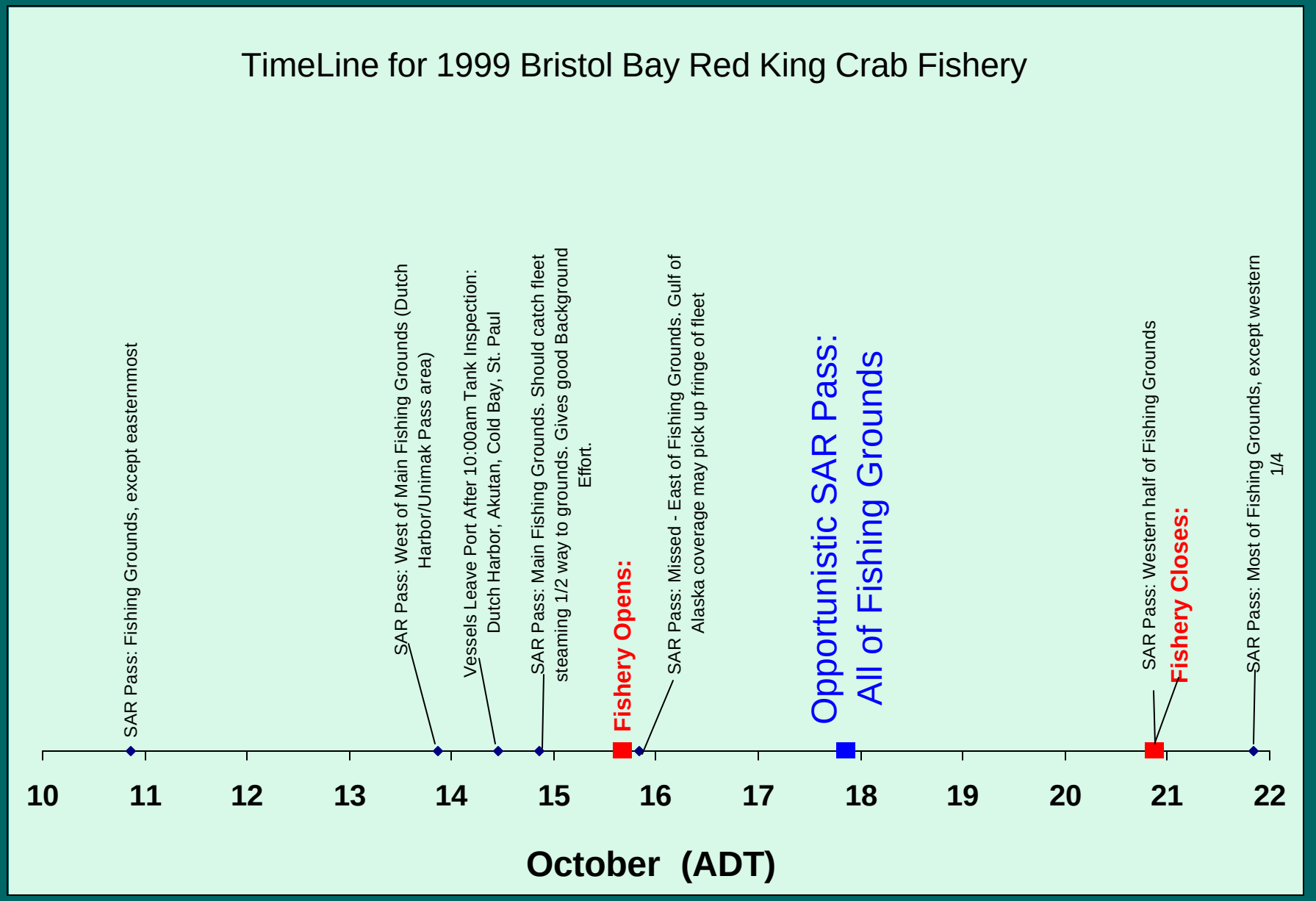


Red King Crab: Setting

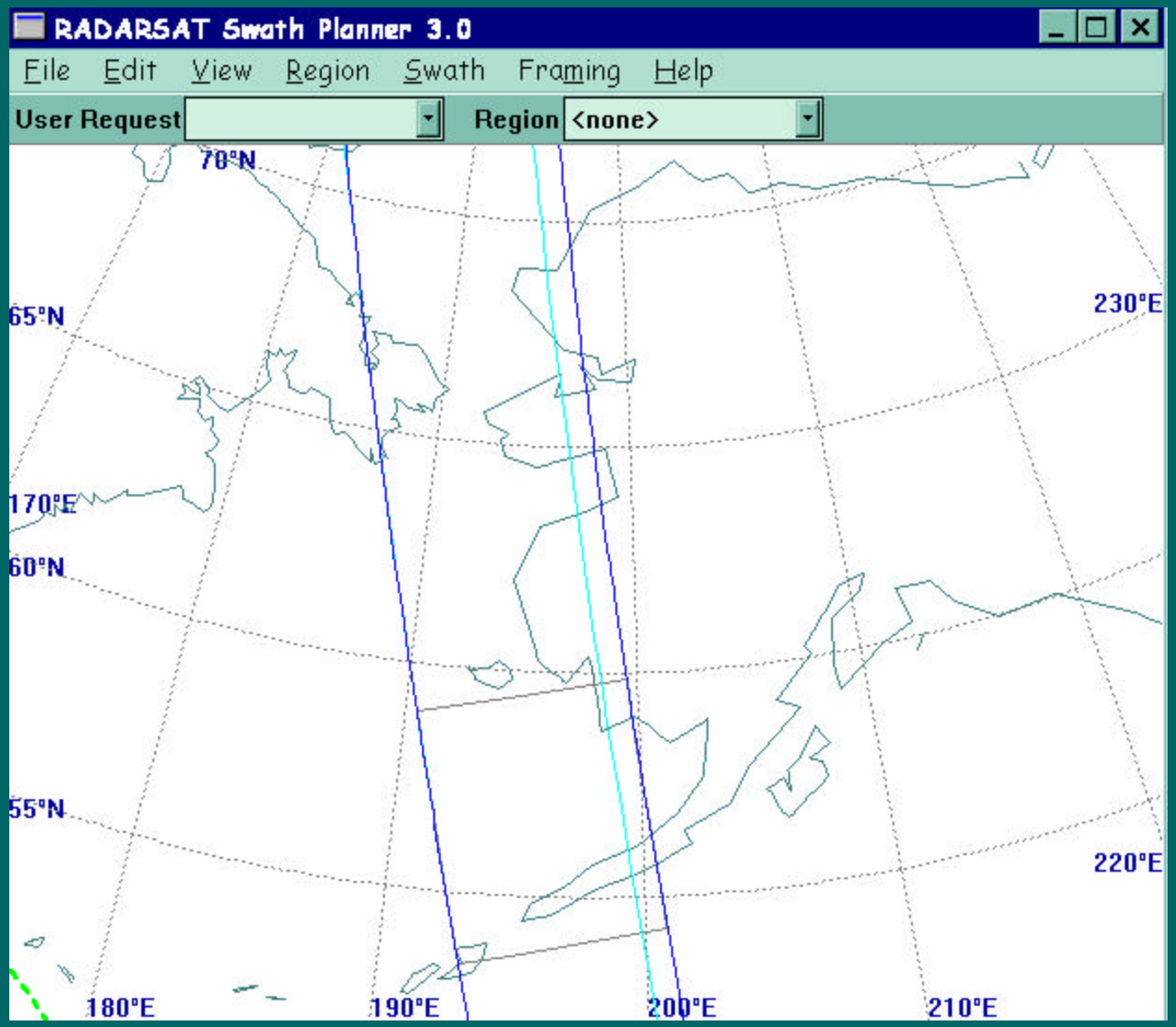
- Random Sampling?
  - 9 Catcher Processors with observers (larger vessels)
  - 262 unobserved vessels
- Inferences:
  - Target Catch Rate (When to Close Season)
  - Bycatch Rate (Tanner crab season closed


Bristol Bay Red King Crab Catch: 1998
N
W
E
S
2 x 2 Degree Lines
Alaska Land Area
Number of Vessels in Area, 1999 Fish Tickets
Low: 12 vessels in aggregate area
4 - 10
11 - 25
26 - 50
51 - 100
200
0
200
400

Fishery and Imagery Timing

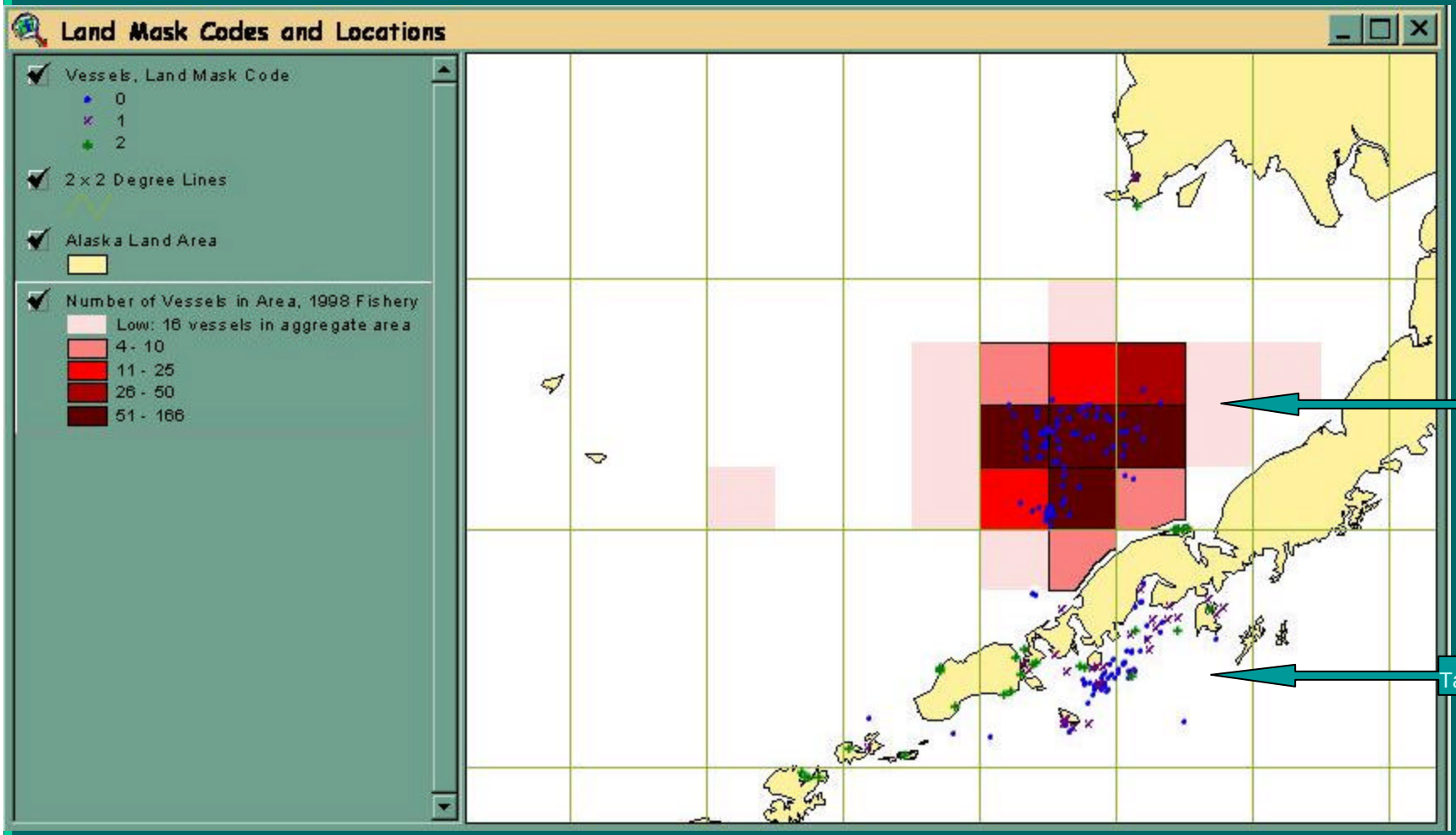


One Radarsat Swath during Fishery

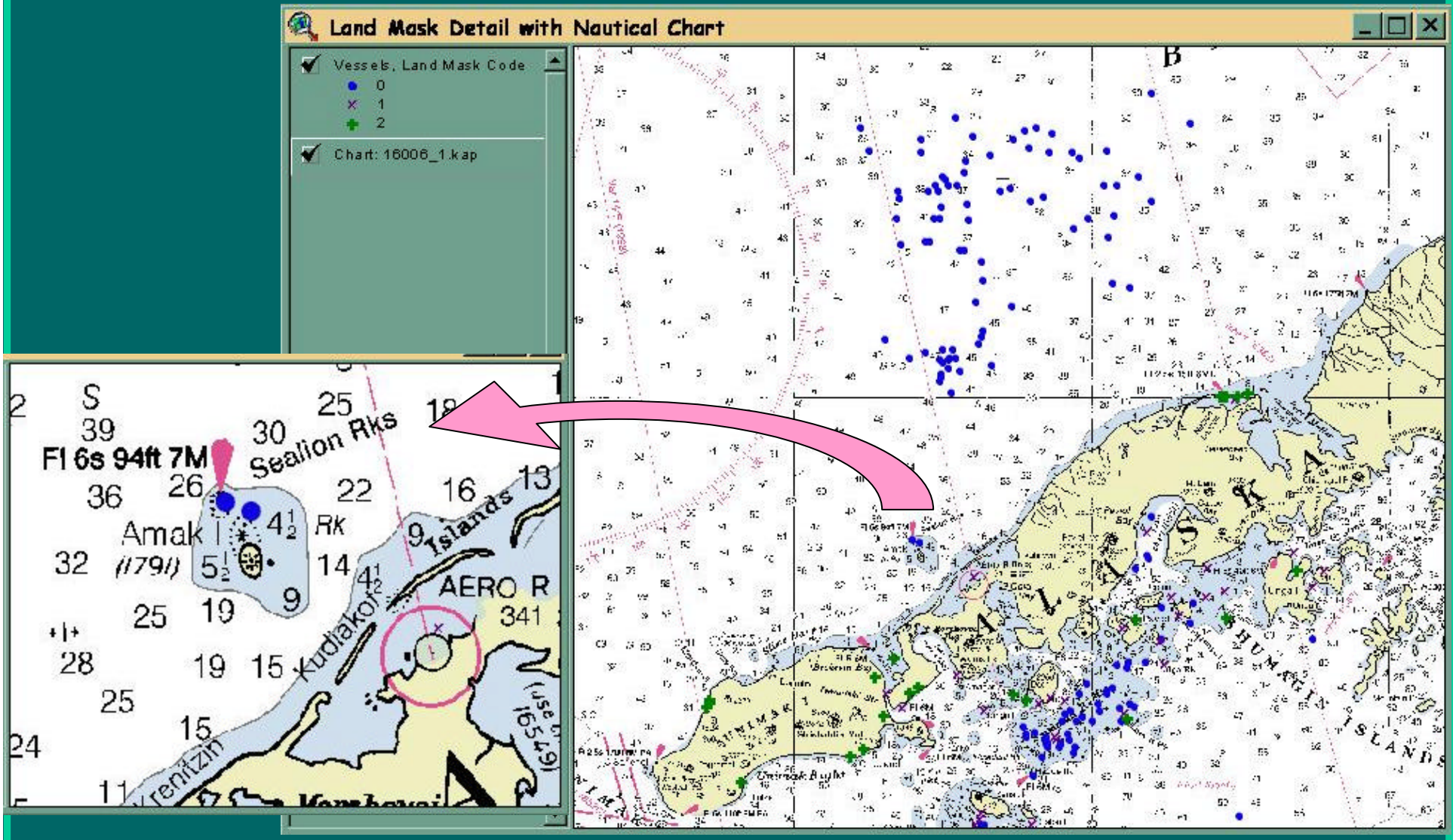


Imagery not of interest (except for target ID)

Well-Defined Region of Interest

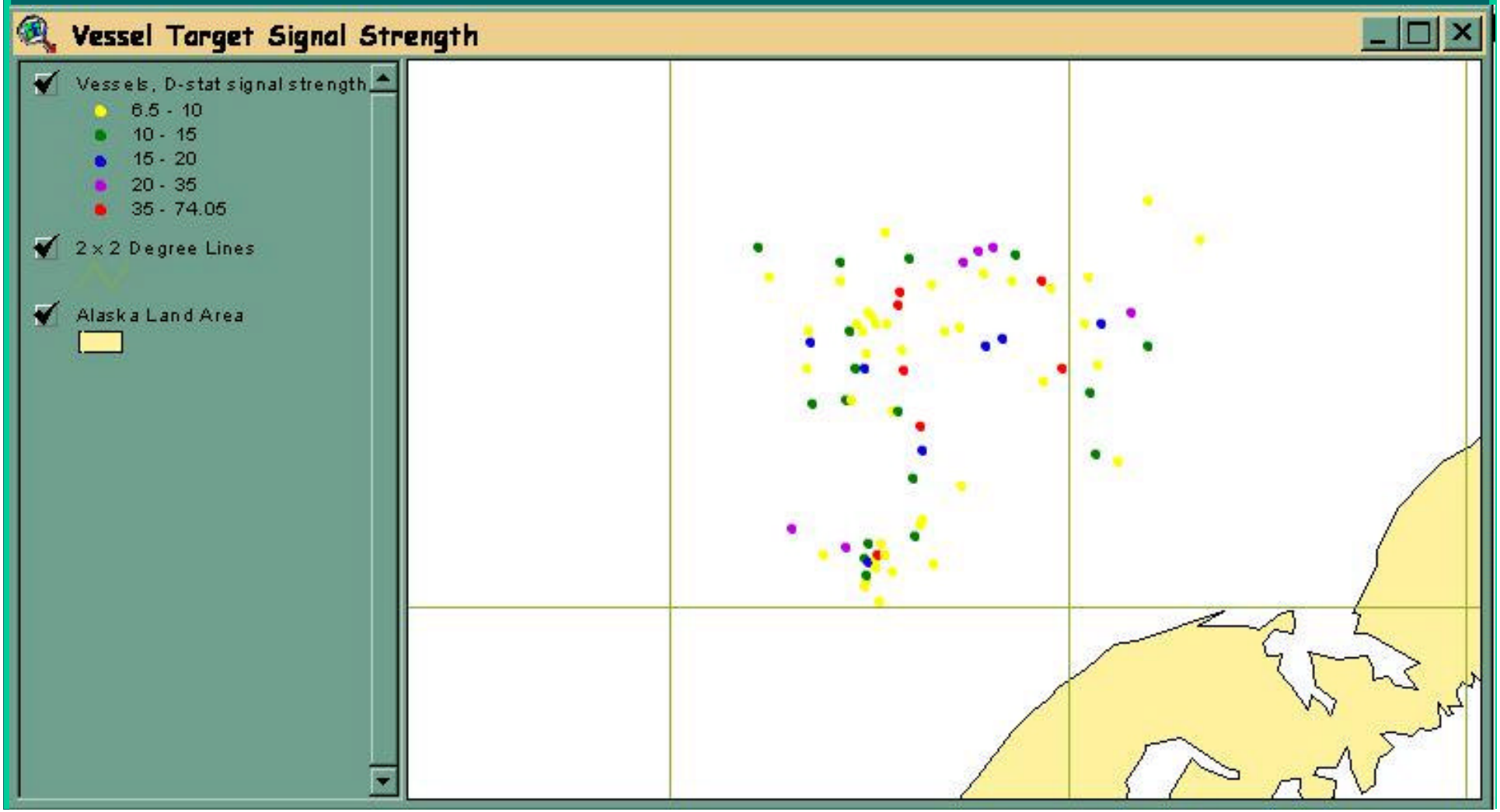


Land Masking not a problem in B.S.

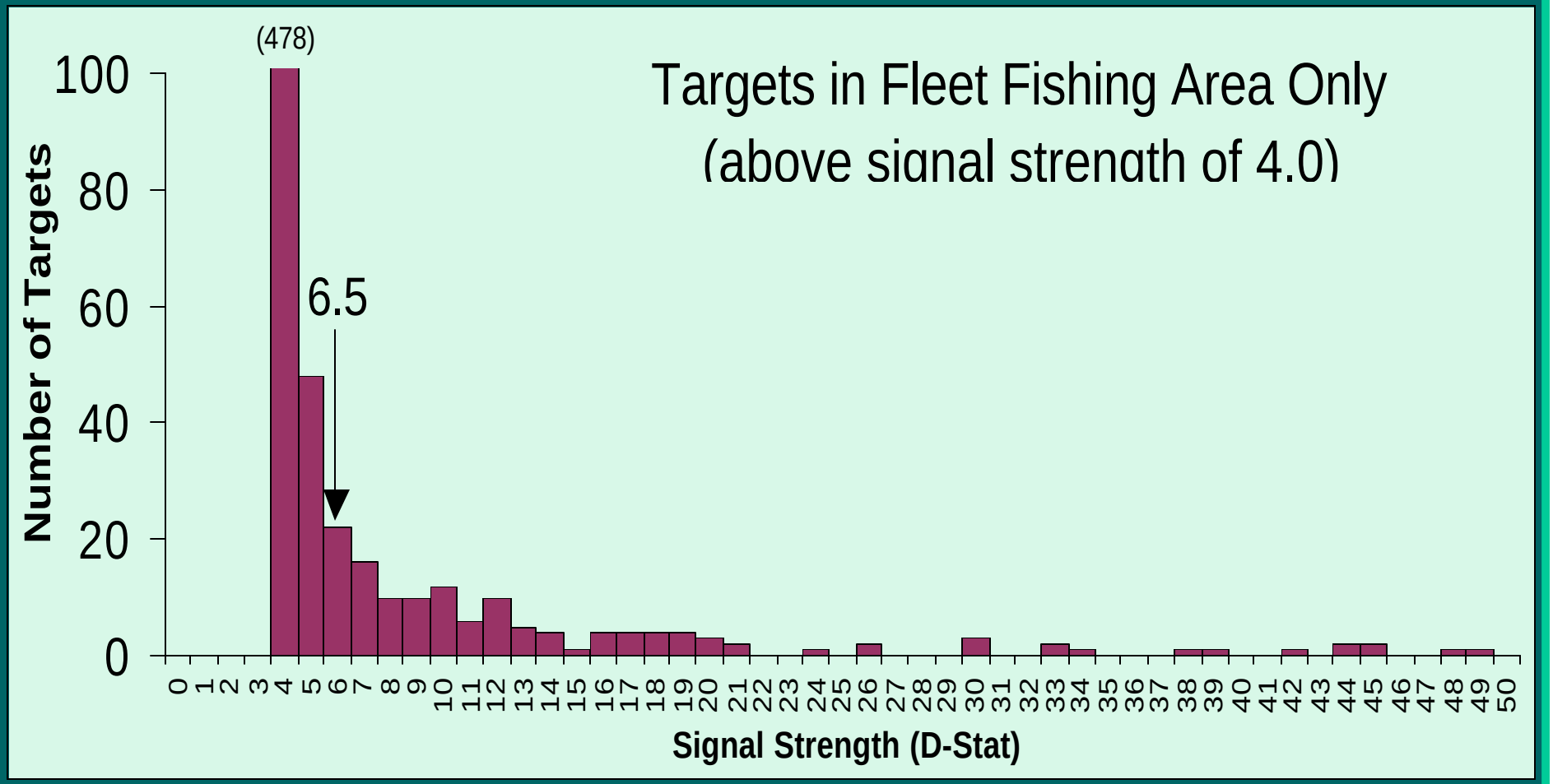


Not Enough Targets?

- 78 Targets in initial analysis
- 273 vessels in fleet

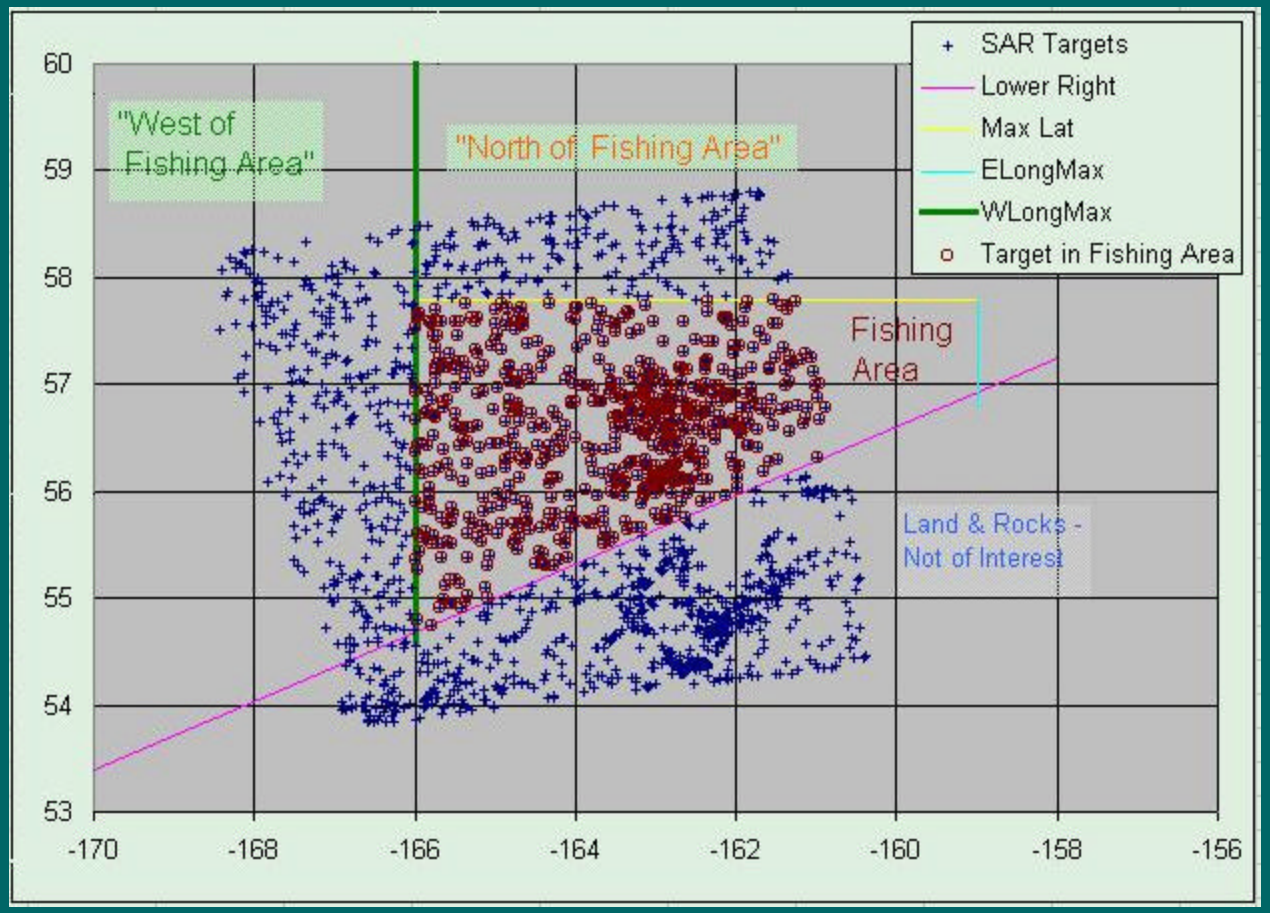


D-Stat Threshold too high?



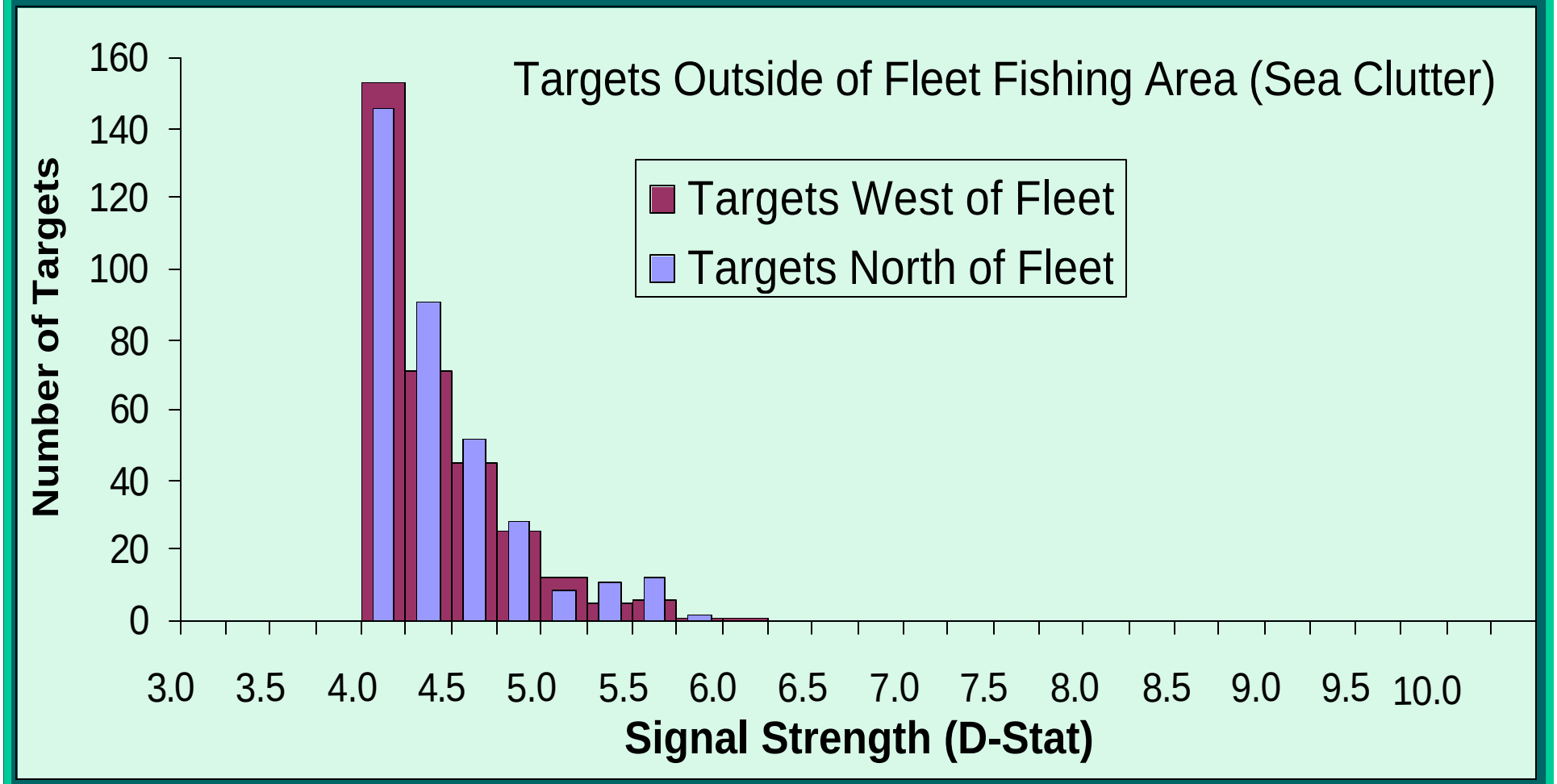
Define “Fishing Area”

Latitude



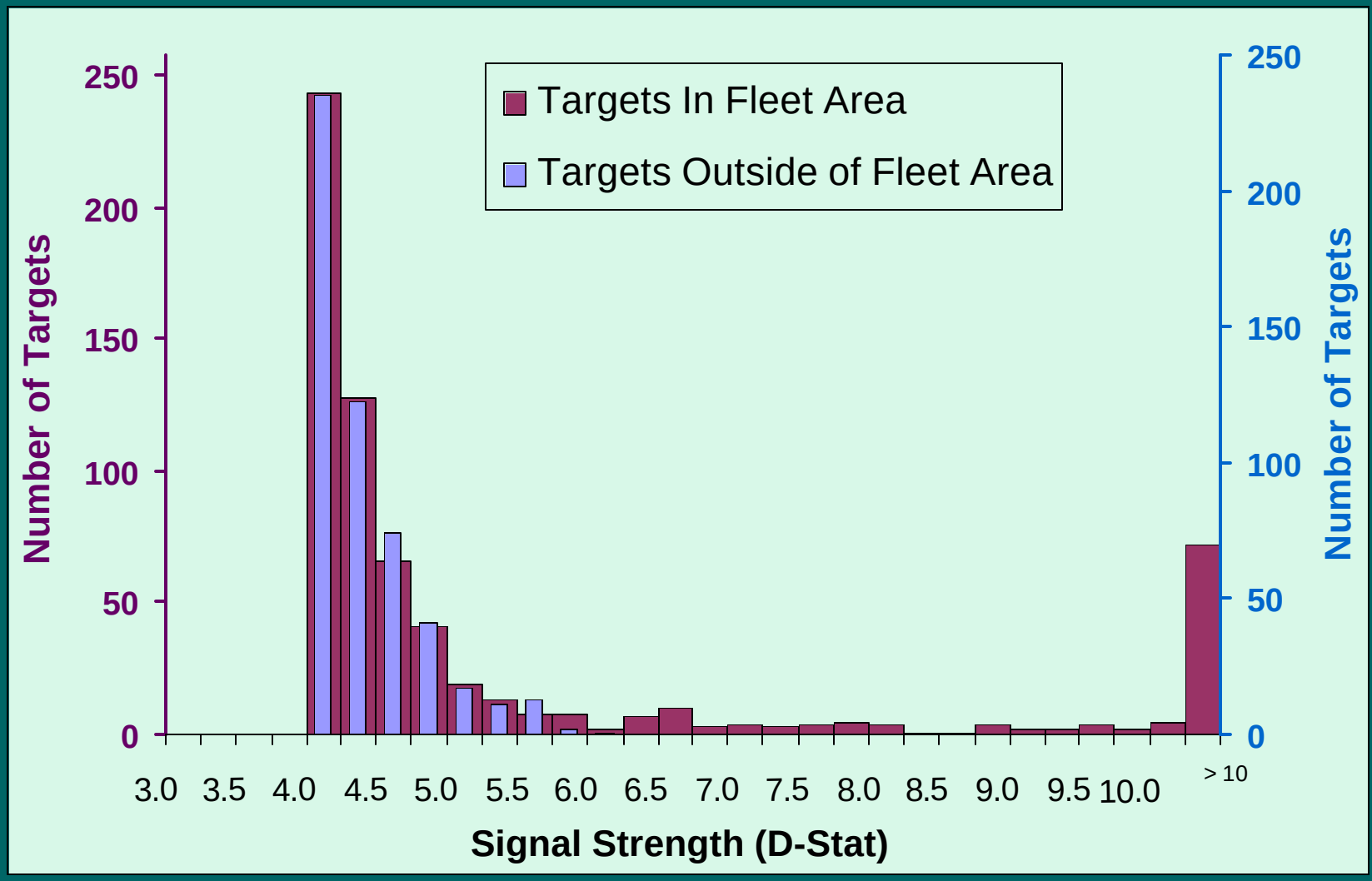
Longitude

Spatial Pattern to “Sea Clutter”?



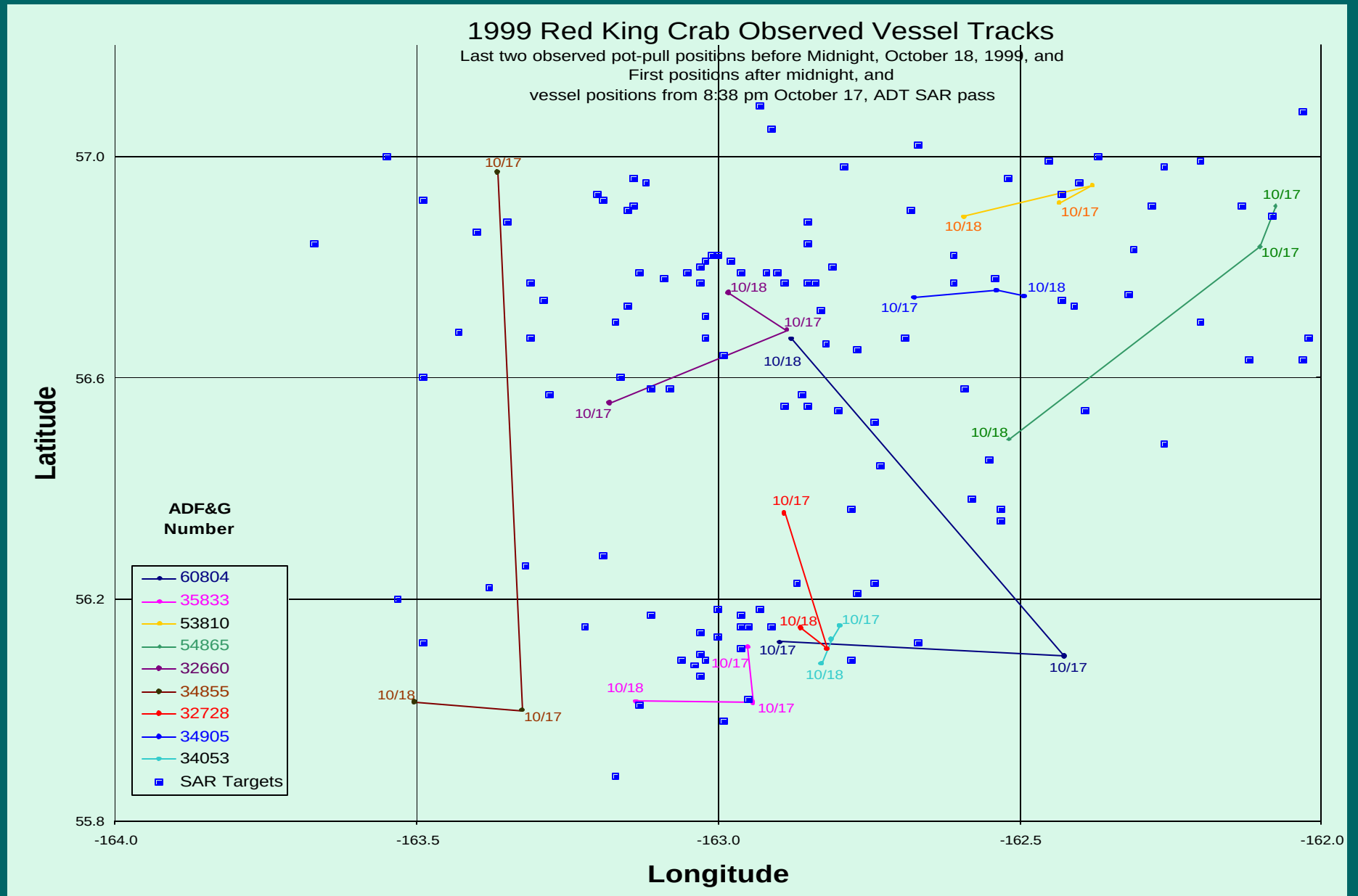
➔Assume “Sea Clutter” behaves similarly across the image

Use “Sea Clutter” to Define Threshold

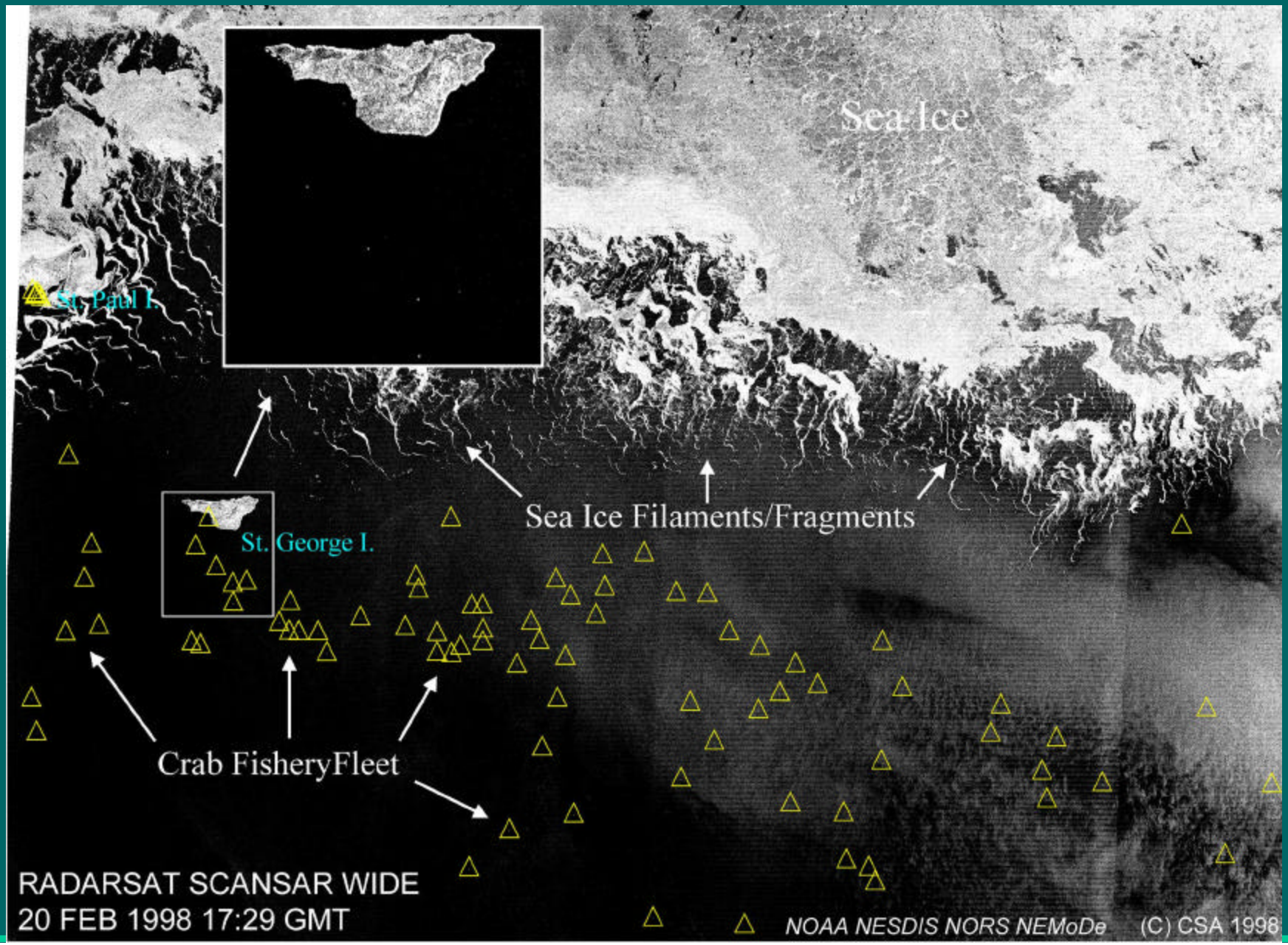


➔Threshold at about 5.75 (still only 151 of the 273 targets)

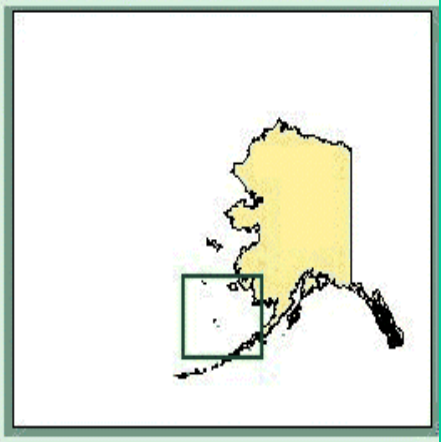
Observed/Unobserved Vessel Comparison



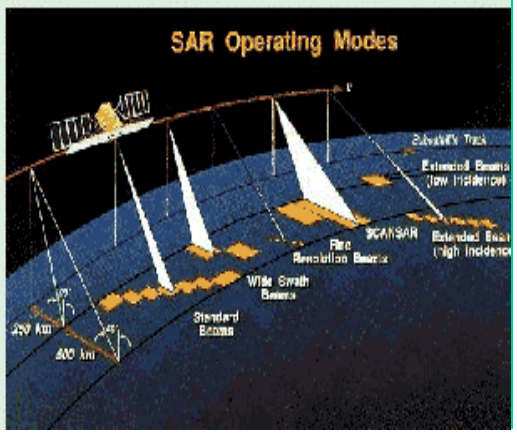
1998 Opilio Crab Fishery (Ice Edge)



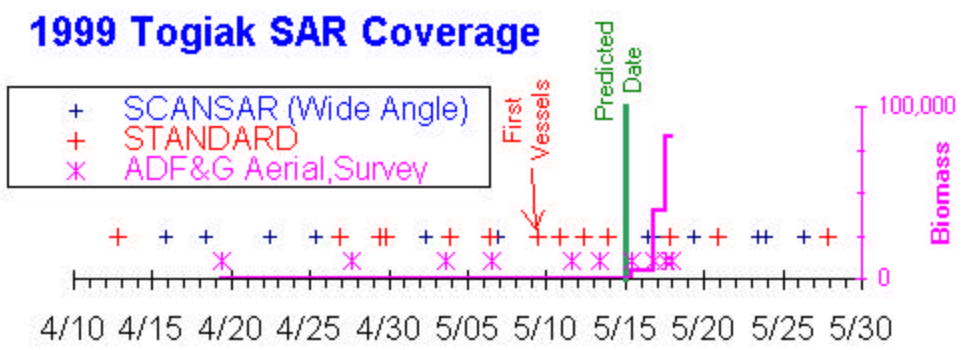
2000 Opilio Fishery

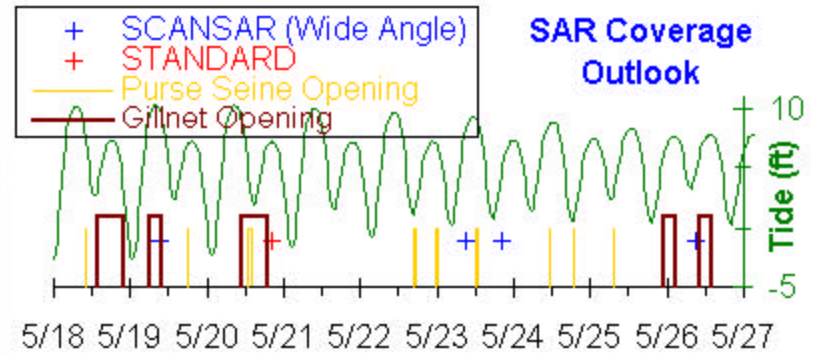


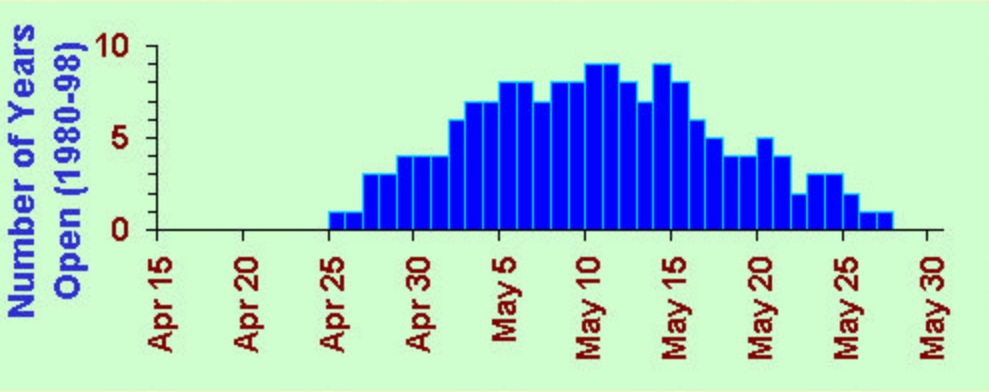
Alaska SAR Demonstration
Vessel positions derived from
RADARSAT-1 Imagery



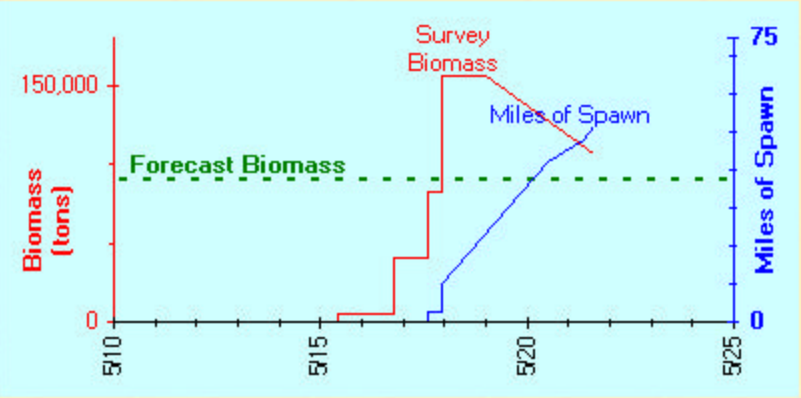
Togiak Herring Decision Support

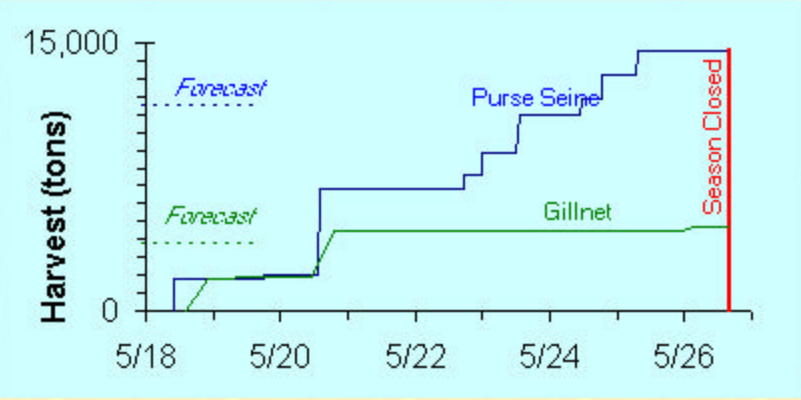




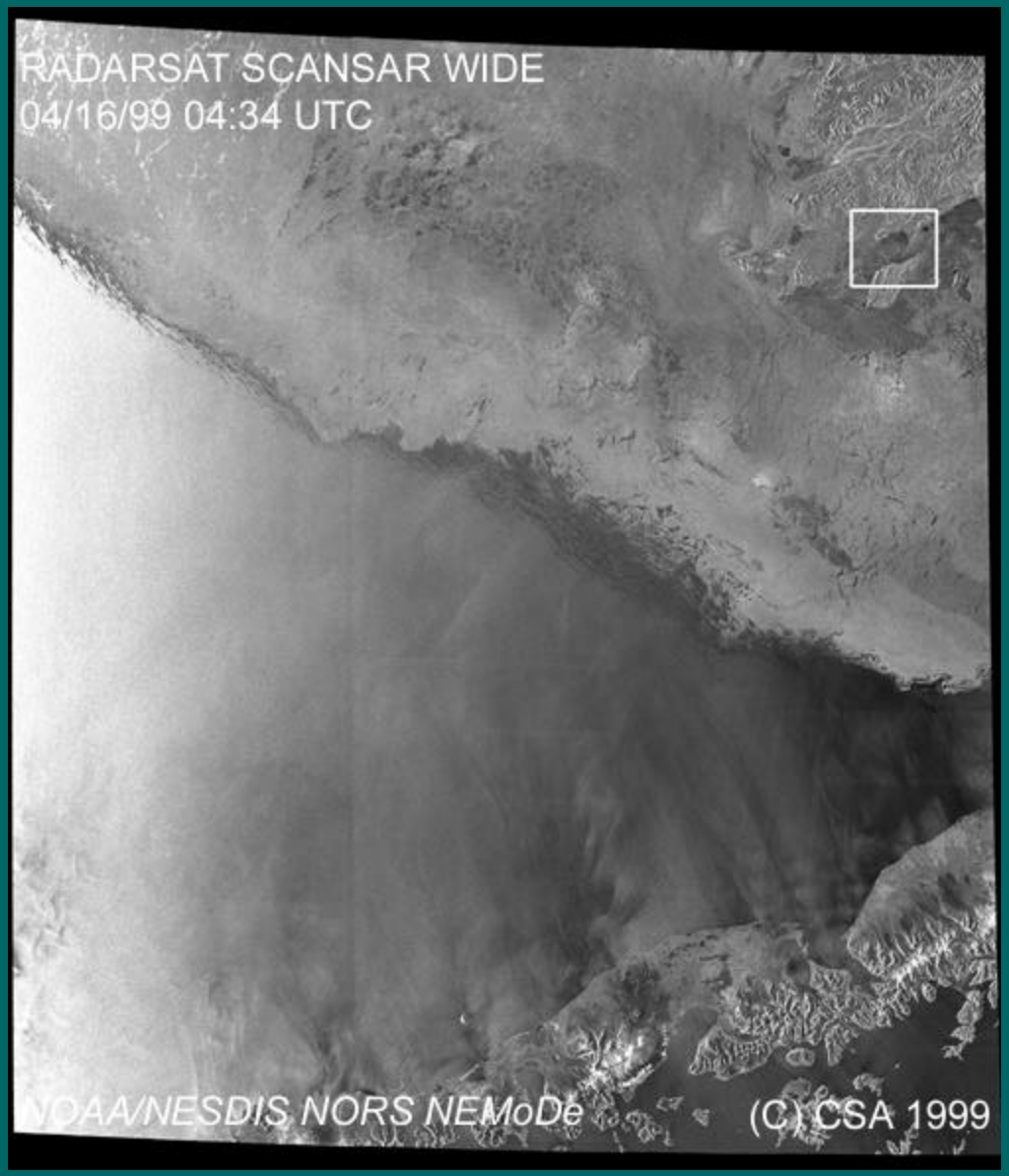


The 1999 Togiak fishery is relatively late



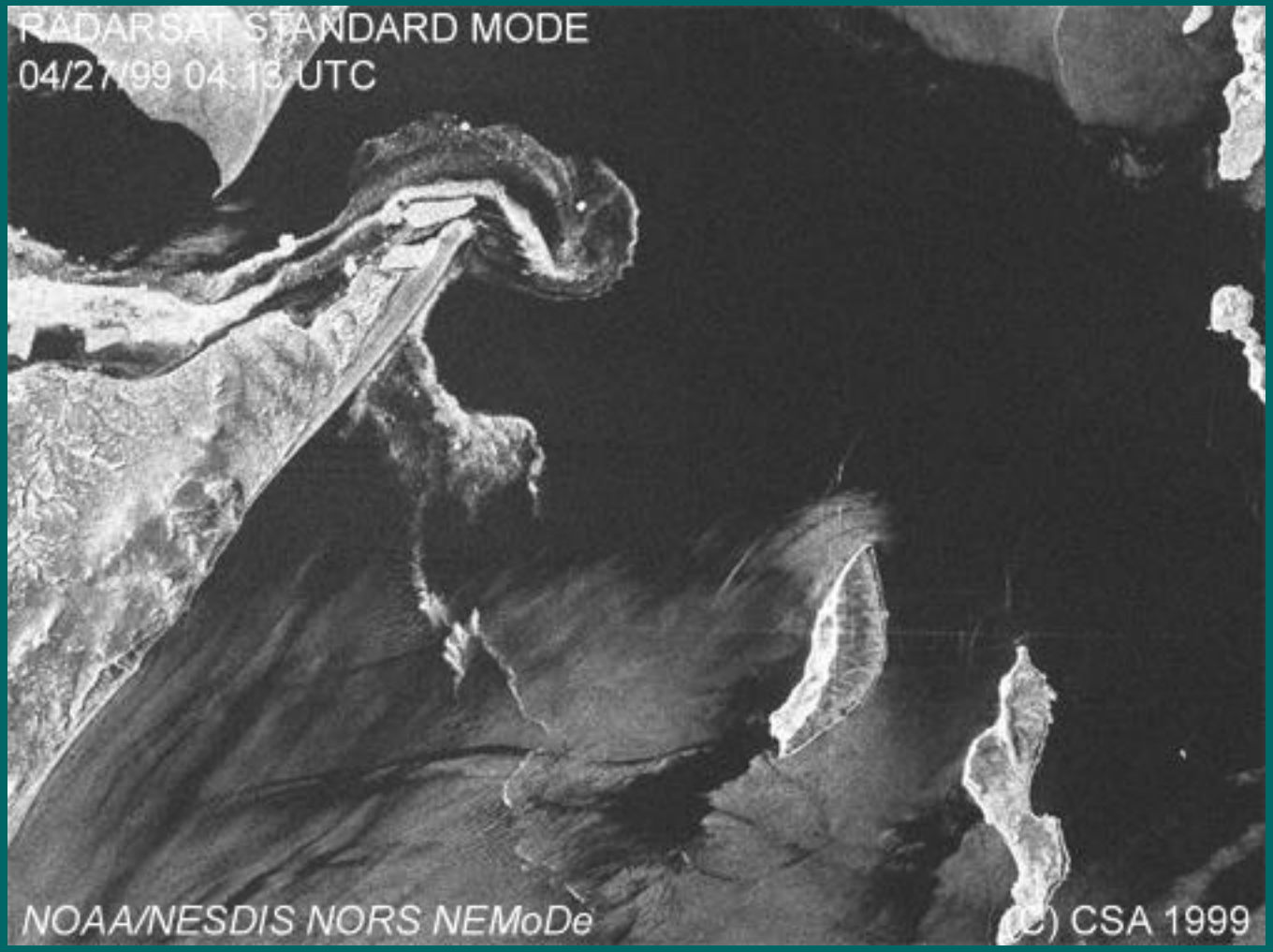


April 16, 1999: Ice Edge Way Down



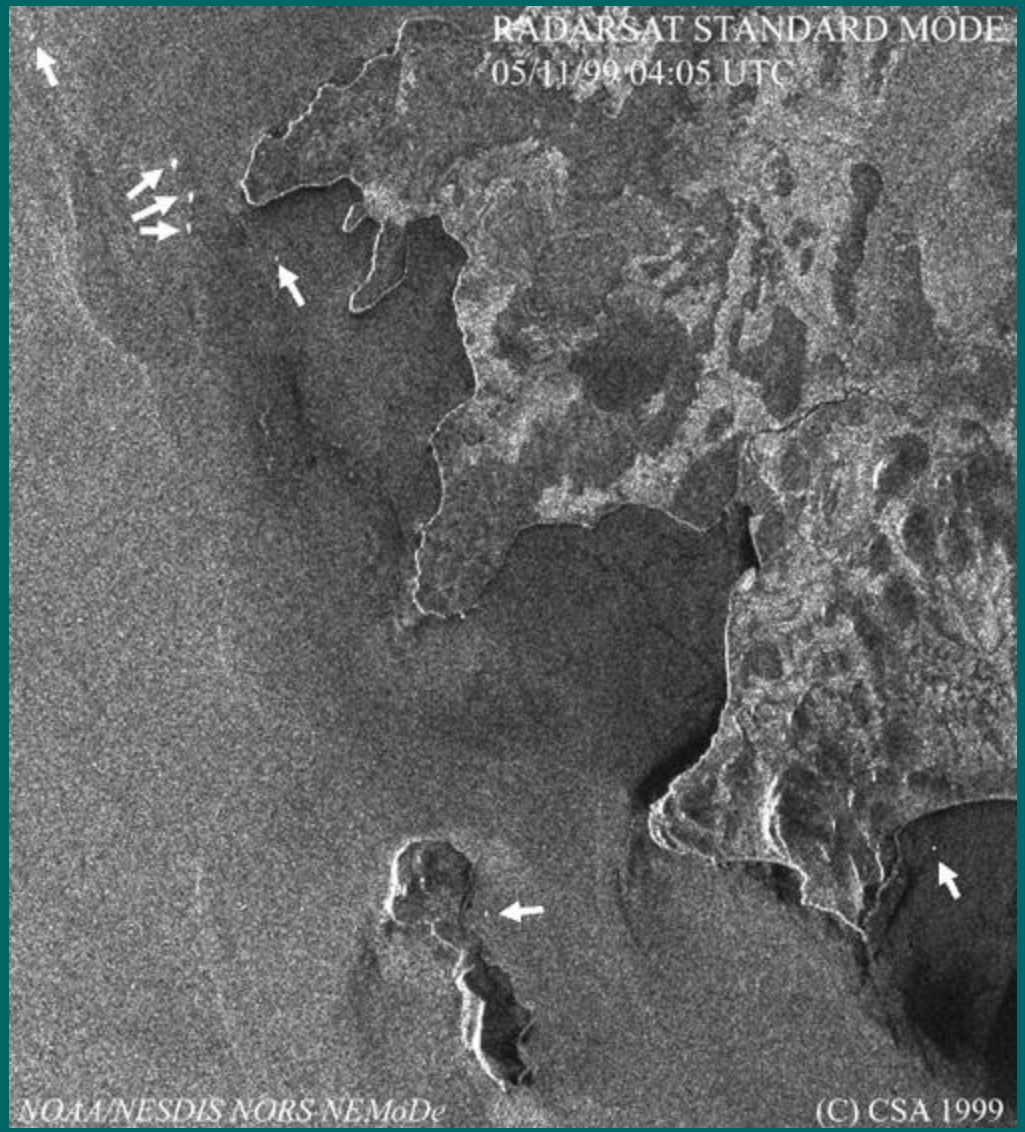
April 22: Ice Begins to Clear

April 27: Currents from ice flow

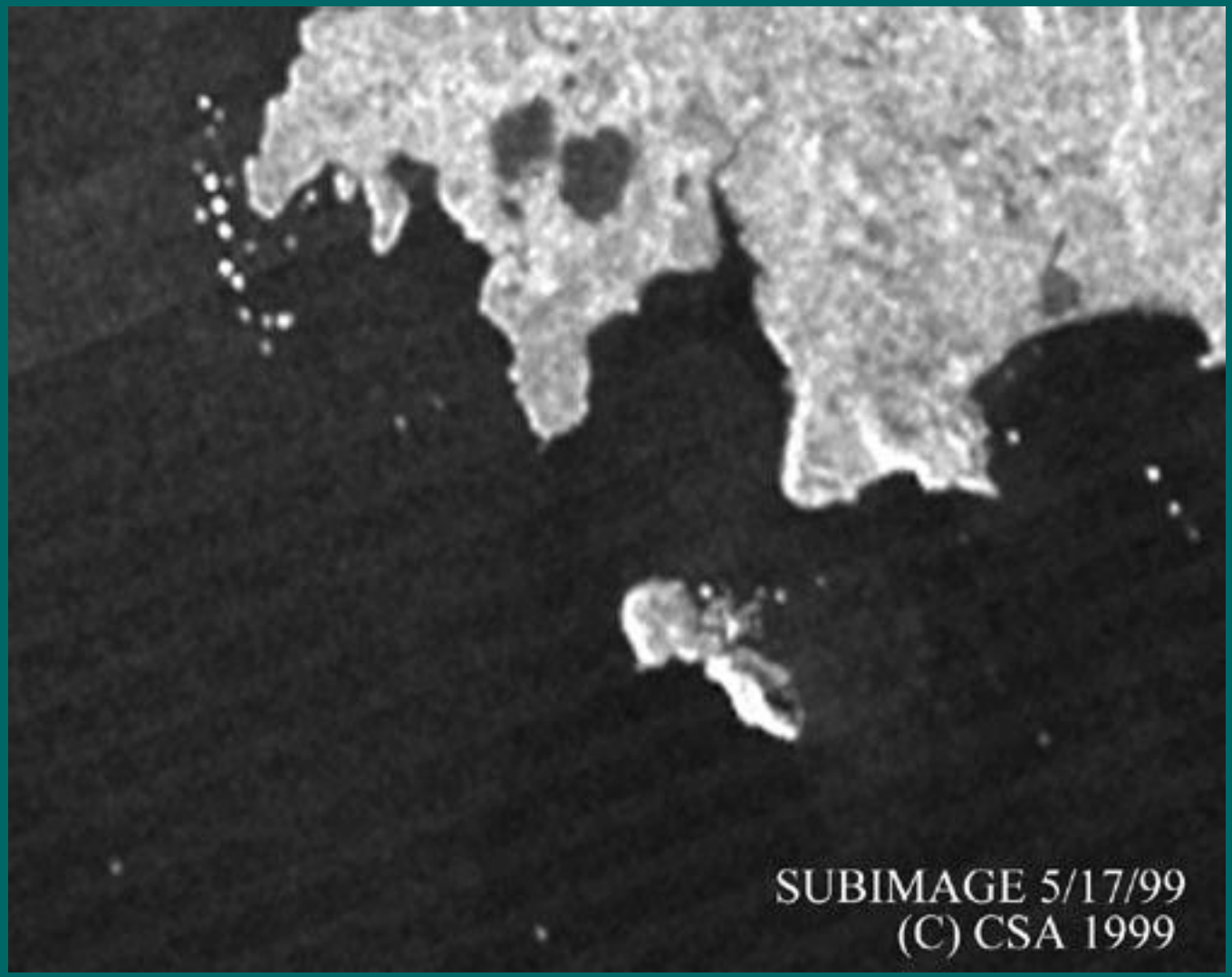


May 10: First Vessels Finally Arrive

May 11: Fleet Building Up

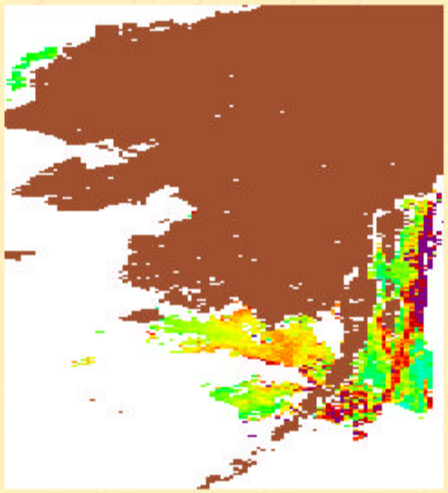


May 16: Just before fishery

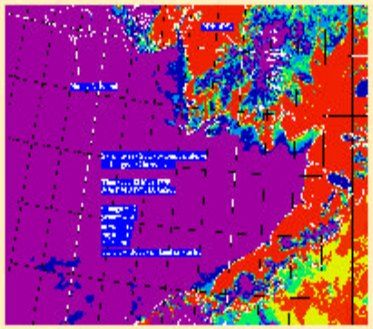


Other Decision Support Info.

May 14 SeaWIFS image: Rare clear weather event allows SeaWIFS satellite to image cholorophyl distribution in Bristol Bay.



(Click on image for more detail)

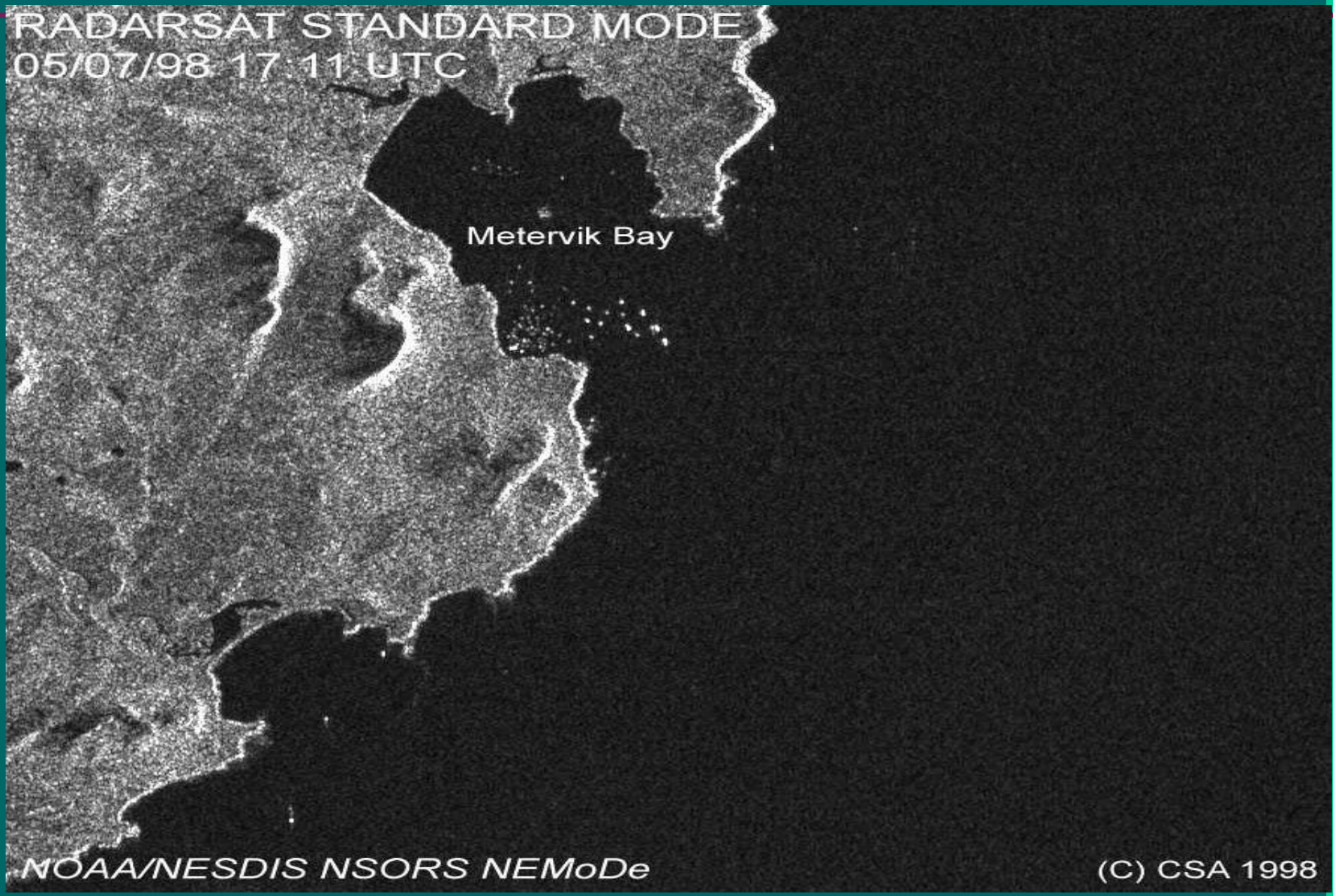


May 13 SST
(Click on image to enlarge)

May 13, 1999 8:17pm ADT Standard mode image shows many more vessels arriving on scene, with clusters clealry visible in the 3 smaller images derived from the large (left) image. Targets visible agree very closely with the morning aerial survey vessel count (see below).

Hagemeister Strait
(Click on image to enlarge)

SAR Resolves 32 foot vessels!



SAR Products of Interest

- ASCII Vessel Positions (fleet distribution)
- SAR Imagery:
  - Ice and Fleet
    - Opilio Ice Edge
    - Herring Fleet arrival at breakup
  - Fleet Descriptions if near landforms (herring)

Fisheries and SAR

- Vessel Monitoring Systems advantages
  - Positive ID – enforcement link
- SAR advantages
  - Passive – fishermen are clever
  - Cheap (compared to VMS)
  - Provides other info (ice, sea conditions)
  - Couple to trigger overflight (best enforcement tool)
  - Less overhead to get “fleet” distribution